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Haul Seining in the Great Lakes

by William G. Gordon

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Cover Photo: Detaching the wing of the haul seine from the hauling line. The wing section is cleared of debris and stacked aboard the barge anchored nearby.

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By

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INTRODUCTION

The haul seine, one of the oldest forms of fishing gear, was fished throughout the Great Lakes area by Indians, traders, and settlers. Commercial fishing began in the Great Lakes early in the 1800's, when professional fishermen introduced the seine in western Lake Erie. Although the total production from seining generally has decreased, the net still is in wide use today. It is generally fished in the shallow bays along each of the lakes, but is also used in the shallow, open-lake waters of western Lake Erie, southern Lake Michigan, eastern Lake Ontario, and in smaller inland lakes for catching carp, goldfish, sheepshead, catfish, bullheads, white bass, gizzard shad, yellow perch, and several other species.

Until the early 1900's seining was performed laboriously by crews of 10 to 40 men. Later, when steam engines were used to power gypsyheads, mechanization of the seine fishery began. Today, equipment powered by electric motors or petroleum engines is used to haul the seine, and the manpower requirement has been reduced from two to four men.

The purpose of this leaflet is to answer the many questions concerning the construction and operation of the haul seine. The discussion presents methods of construction and operation that are practical in the present haul seine fishery of the Great Lakes.

MATERIALS

Materials for construction of haul seines range from the small-diameter twine of the webbing to the larger diameter cordage used for floatline, leadline, bridles, and hauling lines. Early seines were constructed of cotton and manila, but since World War II various polyamide fibers have found wide use and frequently have replaced completely these natural materials.

Twine Size

Twine intended for manufacture into fishing nets is classified according to the number of yarns or threads it contains (table 1). For example, No. 9-thread twine contains 3 strands of 3 threads twisted into a single strand, and No. 12 has 3 strands of 4 threads each. Most seines used around the Great Lakes have webbing knitted from 12- or 15-thread twine, but some fishermen who fish nets in areas where abrasion is a problem may use nets made wholly or in part of heavier material, such as 18- or 21-thread twine.

Mesh Size

Mesh size may be measured and defined in terms of bar (or square) and stretched (or extension) measure (fig. 1). Bar measure is the linear dimension of the one side of the square mesh including one knot. Stretched measure is the distance between two opposite knots when under tension and may include one or both knots. Some State statutes provide for an "inside" measure and, thus, exclude both knots.

Webbing with mesh size ranging from 3 to 8 inches (stretched measure) is used in wing sections of haul seines. The bag section has webbing with smaller mesh size, generally 2-1/2 to 3 inches. The final choice of mesh size depends upon the species sought and on restrictions imposed by various regulatory agencies.

Cordage

Generally, rope up to 1/2-inch diameter is classified by either diameter or number of threads and type of construction; rope over 1/2-inch diameter is classified by either circumference or diameter and type of construction (table 2). Rope in common usage is 3-strand, medium, right-hand lay; either soft or

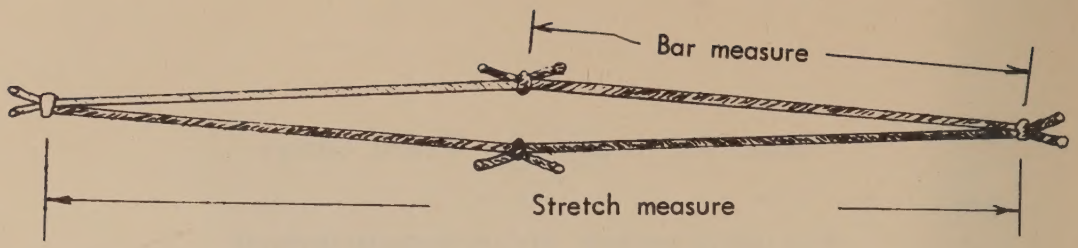

Figure 1.--Two methods for measure of mesh size.

hard lay may be used. The terms "right-hand lay" and "left-hand lay" refer to the direction of twisting, and "soft," "medium," and "hard" designate the amount of turn put in the rope. Floatlines, leadlines, and hauling lines are generally 3-strand, medium lay, manila rope. Leadlines are usually built of paired ropes--one left-hand lay and one right-hand lay. Sizes range from 3/8- to 5/8-inch diameter, depending upon the size of the seine and choice of the fisherman. Hauling lines are usually 3/4-inch or smaller diameter, medium lay rope.

Largely because of the higher price for rope manufactured from synthetic material, most fishermen still use manila rope which, properly treated, has a service life of several years; lower cost offsets the extra service life of the synthetic counterpart.

Table 1.--Specifications for cotton, Nylon, Dacron, and ploypropylene--medium lay seine twine. (Complete data not yet available on tensile strength of polyethylene.)

Twine No.	Approximate length per pound					Approximate tensile strength				
	Cotton (medium)	Filament nylon	Spun nylon	Spun Dacron[1]	Spun polypropylene	Cotton (medium)	Filament nylon	Spun nylon	Spun Dacron[1]	Spun polypropylene
	Feet	Feet	Feet	Feet	Feet	Pounds	Pounds	Pounds	Pounds	Pounds
6	3,475	3,780	3,720	2,704	5,020	12	44	25	24	31
9	2,200	2,370	2,480	1,816	3,990	18	70	36	33	35
12	1,600	1,710	1,800	1,348	2,250	24	80	49	47	60
15	1,300	1,320	1,350	1,080	1,800	30	110	62	58	70
18	1,100	1,050	1,120	996	1,530	36	138	73	71	90
21	950	930	960	768	1,290	41	150	86	82	97
24	800	840	840	672	--	46	170	97	95	--
27	700	690	740	592	--	52	190	108	107	--
30	650	645	670	536	850	58	210	121	116	135
36	545	555	555	445	--	68	240	144	141	--
42	460	480	470	376	--	81	260	168	164	--
48	400	450	410	328	--	98	300	192	177	--
54	360	405	365	293	--	108	345	216	201	--
60	265	345	328	254	470	119	400	244	233	250

[1] DuPont tradename, polyester fiber.

Table 2.--Specifications for manila, Nylon, Dacron, polyethylene, polypropylene, and Mylar--3-strand medium lay rope

Thread No.	Size		Approximate tensile strength							Approximate weight per 100 feet						
	Diameter	Circumference	Manila	Nylon	Dacron[1]	Polyethylene	Polypropylene		Mylar[2]	Manila	Nylon	Dacron[1]	Polyethylene	Polypropylene		Mylar[2]
							Monofilament	Multifilament						Monofilament	Multifilament	
	Inches	Inches	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
fine 6	3/16	5/8	450	960	720	700	800	870	1,050	1.5	1.0	1.2	.74	.71	.89	1.36
6	1/4	3/4	600	1,500	1,150	1,200	1,300	1,200	1,400	2.0	1.5	1.9	1.25	1.20	1.25	1.97
9	5/16	1	1,000	2,400	1,750	1,750	1,900	2,050	--	2.9	2.5	3.1	1.88	1.84	2.18	--
12	3/8	1-1/8	1,350	3,400	2,450	2,500	2,750	2,700	2,725	4.1	3.5	4.3	2.94	2.85	2.94	4.00
21	1/2	1-1/2	2,650	6,200	4,400	4,100	4,200	4,700	5,200	7.5	6.5	8.0	5.00	4.75	5.20	7.50
	5/8	2	4,400	10,000	7,300	5,200	5,800	8,000	6,750	13.3	10.5	13.3	8.10	7.70	9.00	13.30
	3/4	2-1/4	5,400	14,000	10,000	7,400	8,200	10,200	10,000	16.7	14.0	17.4	11.50	11.00	11.50	15.40
	7/8	2-3/4	7,700	19,000	13,600	10,400	11,500	15,000	15,500	22.5	19.5	25.0	16.20	15.40	17.20	21.20
	1	3	9,000	24,000	16,500	12,600	14,000	16,500	18,000	27.0	26.0	30.5	19.60	18.70	19.00	26.30
	1-1/8	3-1/2	12,000	31,500	21,600	16,500	18,300	22,000	--	36.0	34.0	40.5	24.90	23.70	25.50	--
	1-1/4	3-3/4	13,500	36,000	24,400	18,600	20,700	24,500	--	41.8	39.0	45.0	28.60	27.20	28.50	--
	1-1/2	4-1/2	18,500	51,000	34,500	26,700	29,700	35,500	--	60.0	55.0	67.0	41.00	39.00	41.50	--
	1-3/4	5-1/2	26,500	75,000	51,000	39,500	43,900	51,000	--	89.5	79.0	99.0	61.20	58.30	60.50	--
	2	6	31,000	89,500	61,000	47,700	53,000	61,000	--	108.0	94.0	117.0	72.50	69.00	72.50	--

[1] DuPont tradename, polyester fiber.
[2] DuPont tradename, polyester film.

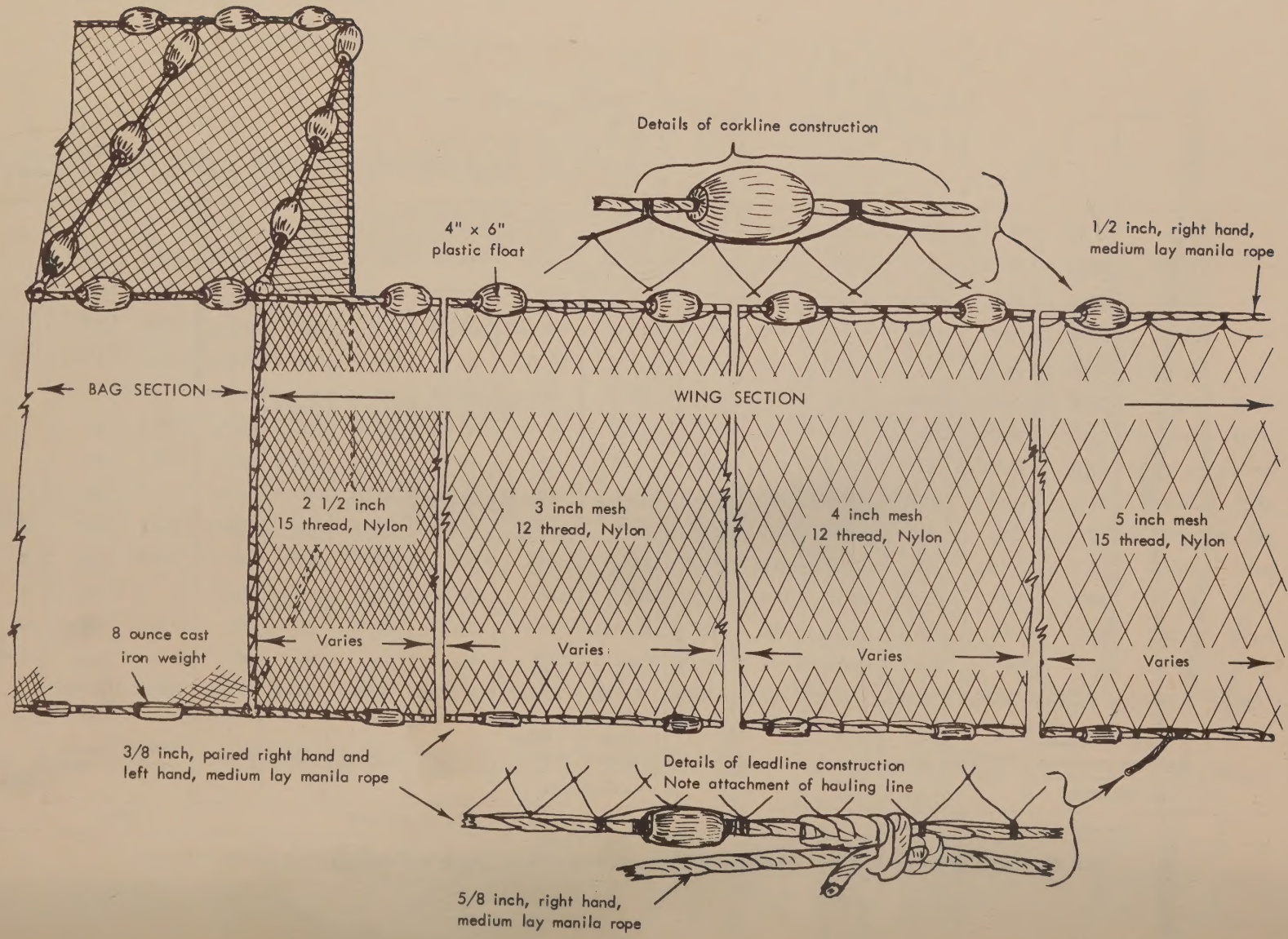

Figure 2.--Construction details of a typical haul seine.

CONSTRUCTION OF SEINES

The construction of seines used by Great Lakes fishermen varies with the individual, the species of fish to be caught, and unique physical conditions of the area in which the net is to be fished. Factors such as depth, type of bottom, and habits and characteristics of the fish must be considered prior to construction. Although the construction of seines varies widely, the same basic pattern is followed, and a single description holds for most of them. Dimensions perhaps are the most variable. A typical haul seine is comprised of two wing sections and a bag, is about 2,400 feet long, and has a depth of about 10 feet (fig. 2).

Corkline and Floats

A 3/8- to 5/8-inch diameter Nylon or manila rope, 2,400 feet long, is threaded through 1,600 sponge-plastic floats, each of which has a 4-inch diameter, is 6 inches long, and has a 5/8-inch center hole. Floats are spaced along the corkline at intervals of 1-1/2 to 5 feet and secured by hangings as the webbing is attached (see insert fig. 2).

Leadline

The leadline is made up of paired left-hand and right-hand lay, 3/8-inch manila ropes to which the bottom selvage of the webbing is hung with seaming twine. Weights, generally 8-ounce and of cast iron, are seized to the leadline at intervals of 3 to 6 feet to keep the net in contact with the bottom. Dropper lines, about 24 inches long, are spliced into the leadline at regular intervals of about 100 feet. These lines, tied onto the hauling lines with an ossel hitch, serve as towing points after the brails are removed (see insert fig. 2).

Wing Sections

The major components of the two wing sections are strips of webbing of mesh size ranging from 8 inches at the wing end to 3 inches at the bag section with double twine or selvage at top and bottom. The wing sections generally are reduced in depth from 10 feet at the bag section to 6 or 8 feet at the wing ends. At intervals of 3 to 4 meshes, a rolling hitch is used to hang the double selvage to the corkline and leadline with seaming twine. Most fishermen use 18- or 24-thread seaming twine.

The top selvage is "hung in" to the corkline on about a 60-percent basis--24 inches of stretched mesh to 14 inches of corkline. The bottom selvage is generally hung in by a lesser percentage (about 55 percent or 24 inches of mesh to 13-1/4 inches) to the leadline to permit the seine wings to assume a cup-shaped configuration during the fishing.

Bag Section

The bag is formed by knitting together five strips of webbing to form a large sack or bag about 20 feet across the open end, 18 feet long, with a depth about equal to that of the wing sections. The mesh size in the bag section is generally 3 inches (stretched) or smaller, depending upon the species of fish that are to be caught. The smaller mesh sizes are used to prevent excessive escapement or gilling of the fish. Rope of 3/8-inch diameter (12-thread) is seized along each seam to strengthen the bag. Floats (metal or plastic), 4-inch diameter and 8 inches long, are attached to top strip of webbing to keep the bag afloat during the fishing.

Brails

Pieces of hardwood, measuring about 2 inches square and 6 to 8 feet long, are seized to the leading edge of each wing section; these wooden pieces and the attached 5-foot rope bridles at each end are known as brails. They keep the wing section open (fig. 3) and are used as the attachment point for the hauling lines by which the seine is towed to shore.

Hauling Lines

The hauling lines consist of two lengths of 1/2- to 3/4-inch diameter, medium lay, manila rope, each about 3,600 feet long. A portion of these lines is attached to the bag section, to each wing section, and to the bridle in such a manner that the entire net can be hauled to shore by the seine winch. The remainder of the hauling lines extending beyond the brails becomes the towlines during the setting operation.

CARE AND TREATMENT OF THE SEINE

All ropes and twines are subject to deterioration by rotting, mechanical wear, and heating due to oxidation of organic matter that may coat the nets. The service life of the net can be lengthened by using preservatives to reduce these factors. Since abrasion is the chief cause of deterioration for seines, protection of the fibers is best provided by treatment with tar or a synthetic coating which fills the spaces between individual fibers and forms a tough skin over the outside. This coating, highly resistant to physical damage, greatly prolongs the useful life of the nets.

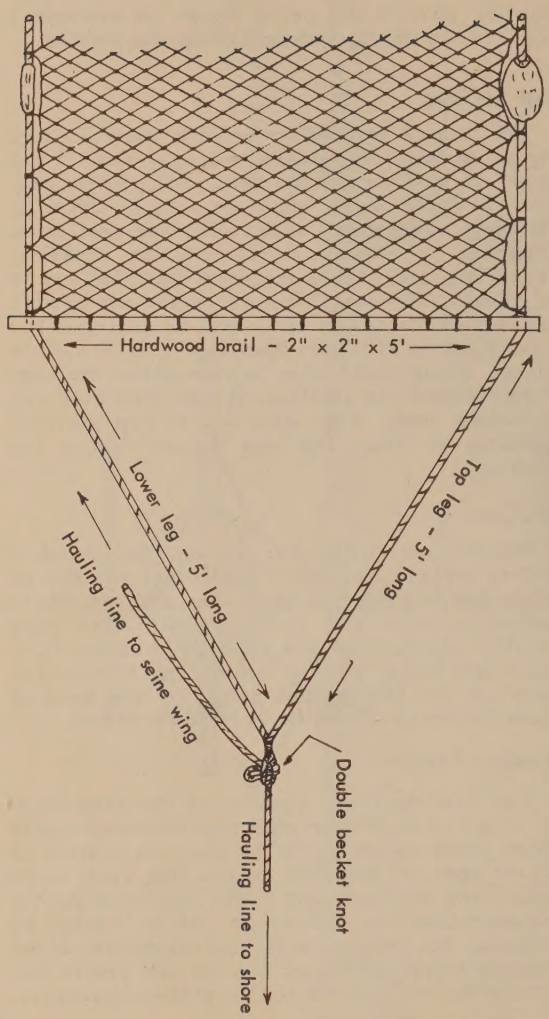

Figure 3.--Construction details of wing end, brails, and bridle. Note attachment of hauling line to bridle and wing end.

Seines, even Nylon ones, should never be stored wet. Preferably, they should be washed free of accumulated dirt and thoroughly dried. The seine must be inspected periodically for small tears, mended, and retreated.

SEINING EQUIPMENT

Power Boat and Barges

Four types of small boats are used for seining operations on permanent grounds: the power or tow boat, seine barge, live-fish barge, and a small skiff (figs. 4, 5, and 6). Tow boats are 16 to 20 feet long, have a draft of 1 to 2 feet, and are powered with a 10- to 40-horsepower inboard or outboard motor. The seine barges range in size from 6 by 12 feet to 8 by 20 feet and are fitted with a flat deck and towing bit. The live-fish barge is of similar size and profile to the seine barge, but the center section is constructed as a large tank for carrying live fish. Water enters the tank through small holes in the bottom. The skiff, about 12 feet long, serves as a tender. On temporary grounds an additional barge measuring about 5 by 12 feet is needed to support the seine puller (fig. 7). All the crafts have shallow drafts to permit near-shore operation.

Seine Winch

All large seines are hauled by winches of similar design. The only differences are the capacities for line pull, hauling speed, and rope coiling. Most permanent grounds are equipped with large units driven by electric or 30-horsepower gasoline engines that provide a wide range of hauling speeds and line pull (fig. 8). The large units are firmly attached to log pilings or concrete foundations. For fishing on temporary grounds where ease of mobility is important, the units are smaller (fig. 9).

The unit consists of two gypsy or warping heads, two automatic coilers, and the multi-speed power train. Towline leads or sheaves are an integral part of some units. On other units these components are attached to anchors some distance ahead of the winch. In either arrangement the leads align the towlines for hauling by the gypsyheads. The smaller units may not incorporate the automatic coilers. Here the lines are coiled by hand (fig. 10).

FISHING GROUNDS AND PROCEDURES

Grounds

Fishermen who regularly fish haul seines select areas reasonably free of underwater snags. Water depth generally does not exceed 12 feet. Many fishermen undertake extensive clearing of an area to avoid costly net damage.

Permanent grounds are fished daily during the open season and are equipped with permanent mechanized devices for hauling the large seines. When fishing is irregular, depending upon the abundance of fish, the weather, and conditions of the lake, equipment is transported to the seining sites by barge and a towing vessel. In either situation, inclement weather may cause the fish to move into deeper water. High winds and waves also may make fishing difficult.

Figure 4.--Power boat used in the haul seine fishery.

Figure 5.--Seine barge, measuring 20 by 8 feet, used in the haul seine fishery.

Figure 6.--Live-fish barge. Note the steel flotation tanks at each end and the compartmented fish tanks.

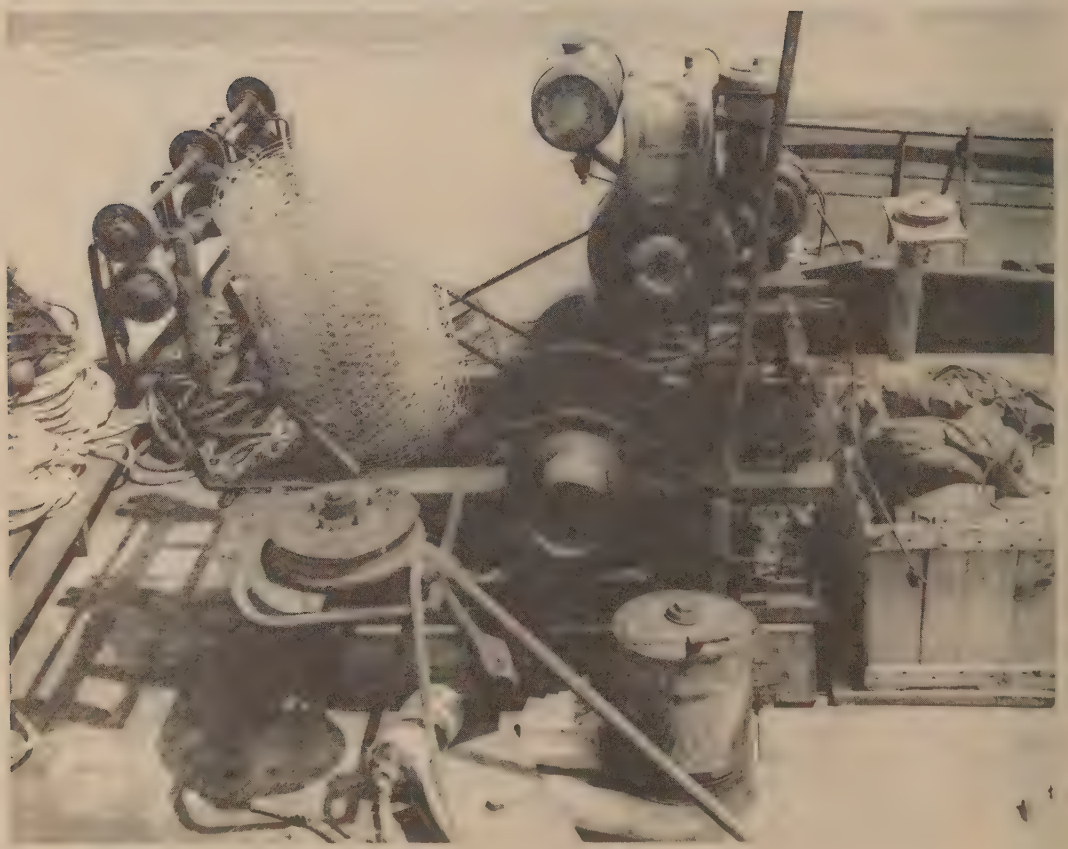

Figure 7.--Small barge used to transport seine puller to grounds where no permanent installation is feasible.

Figure 8.--Seine winch installed on shore at permanent fishing site. Note the operation of the coiling mechanism.

Figure 9.--Portable seine winch anchored along each ready for fishing.

Figure 10.--Gypsyhead powered by a small gasoline engine for temporary use during seining in a small inland lake.

Procedures

Seining begins with stacking of the net and hauling lines aboard a barge in a fashion that facilitates setting. One towline is coiled as far forward on the barge as possible; then the first wing, bag, final wing, and the remaining towline are stacked in that order and the hauling lines are attached to the net sections (fig. 11). If the net and lines are stowed properly, they can run out without becoming fouled while the boat is traveling at a good speed.

When the seine is to be set, the first towline is passed ashore and attached to the winch. This towline is paid out and passed through a sheave located about 500 feet alongshore from the winch. The seine is then usually set in a counterclockwise fashion into an oval or shallow inverted "U" shape (fig. 12A). The power boat then pays out the second towline as it heads for another sheave located the same distance opposite the winch from the first sheave. Once near shore, the power boat and barge are anchored, the towline passed through the other sheave, carried to the winch, and hauling commences (fig. 12B).

The lines are first hauled at the rate of 60 to 80 feet per minute, but as the wing sections near shore, the speed is reduced to 20 to 30 feet per minute. Once the wing sections reach the alongshore sheaves, the winch is stopped while the towlines are released from the sheaves and placed in another pair located near the seine winch (fig. 12C). Hauling is resumed until the bridles reach the second pair of sheaves. At this time the hauling is halted while the bridles are detached from the towline. The seine is then hauled without further interruption as the dropper lines are detached during the operation and the wing sections stacked back aboard the seine barge until the bag reaches shore (fig. 12D). During

Figure 11.--Haul seine stacked aboard the barge ready for fishing.

stacking the sequence followed in the original process is repeated except that the center deck is reserved for the bag (fig. 13).

The mobile seining outfits may vary this procedure according to fishing conditions. In general, the barge carrying the seine winch is anchored near the beach and sheaves anchored nearby in much the same fashion as on the permanent grounds. A backstop, constructed of iron rods with hooks at the top and 2-inch-square mesh wire fencing, is erected ahead of the winch to retain the catch in the net as it is hauled (fig. 14).

During hauling the seine is brought to the beach in the usual fashion. Once the leadline on the bag section reaches the backstop hauling ceases; the leadline is raised and hung on the hooks on the backstop supports; and the catch removed.

The catch is "dried up" in the seine bag by hanging the excess webbing on wooden pins set into the rail of a small skiff (fig. 15). This process is continued as the fish are removed from the bag and placed into live-fish barges or in boxes or trucks on shore (fig. 16). Catches may run as high as 60,000 pounds, but the usual catch is considerably less, generally 3,000 to 5,000 pounds.

Once the fish are removed the bag is stacked aboard the seine barge between the wing sections, and the seine is ready for another set. One complete seine set may last 2 to 5 hours, depending upon the length of the seine and the quantity of fish captured. As many as four sets may be completed daily.

In favorable circumstances in shallow water, seining is far more productive than entrapment gear, such as fyke nets, trap nets, or pound nets. Not only is the weight of the fish caught greater but the savings in capital outlay and wages are considerable. This skilled method of fishing, properly executed, brings excellent results.

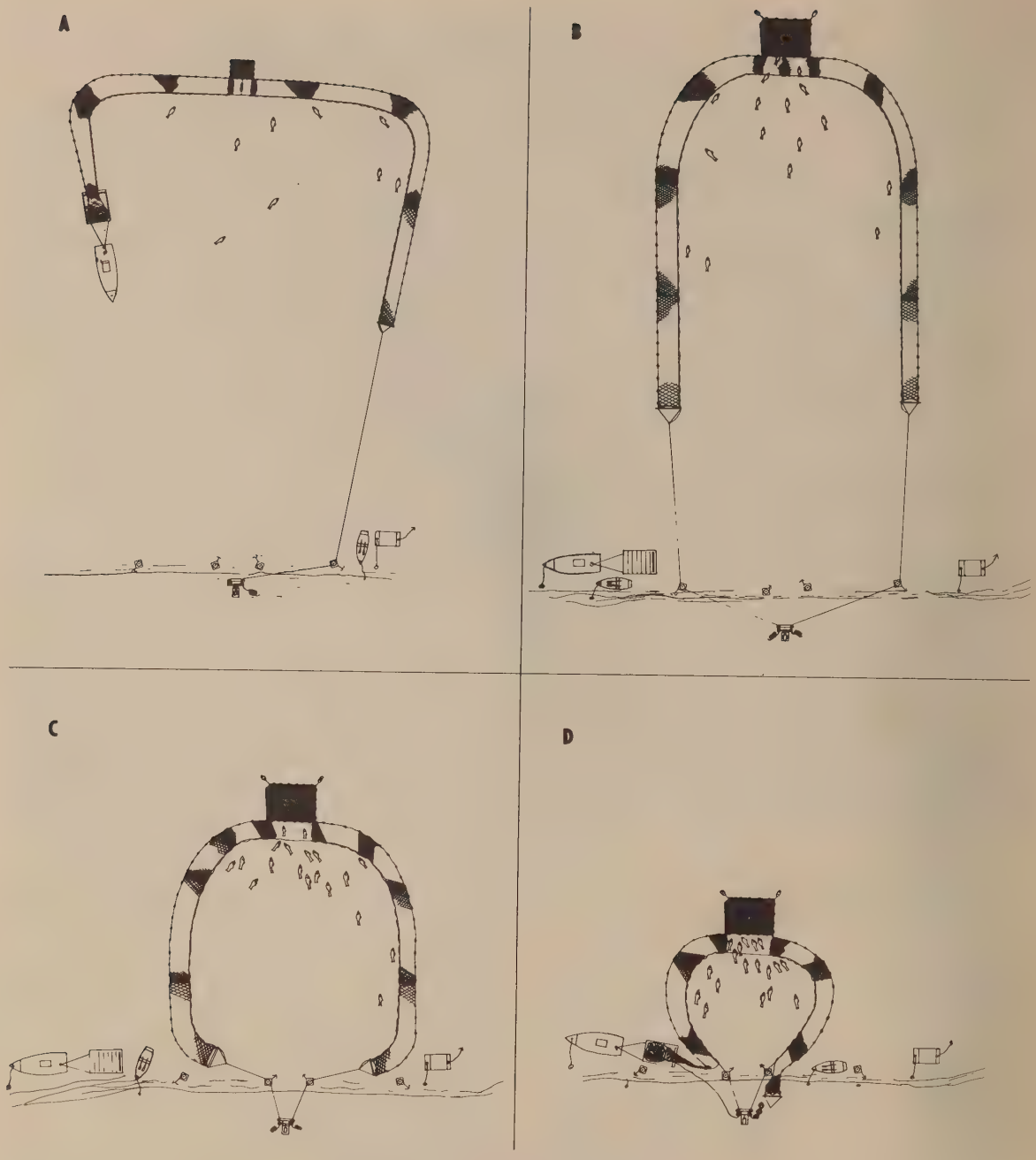

Figure 12.--Operation of the haul seine.

Figure 13.--Restacking the haul seine aboard the seine barge.

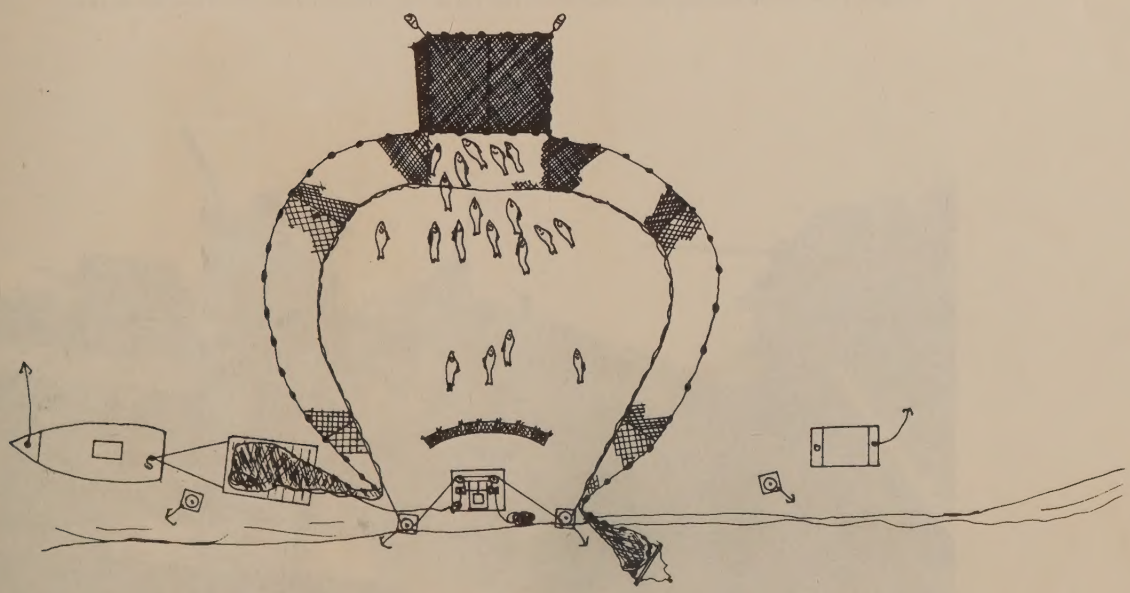

Figure 14.--Sketch showing the use of wire-fencing backstop to retain the catch in the seine bag.

Figure 15.--"Drying up" the catch. The small skiff is being moved into position and the leadline raised to entrap the fish completely within the seine bag.

Figure 16.--Transferring the catch from the seine bag directly into the live-fish barge.

SELECTED REFERENCES

COLLINS, J. W.
1891. Vessels and boats employed in the fisheries of the Great Lakes. U.S. Comm. Fish and Fish., pt. 15, Rep. Comm. 1887 (1891): 19-29.

EDERER, R. J., COMPANY.
1948. Commercial fishermen's reference book. 2d ed., 51 p.

KNAKE, BORIS O.
1947. Methods of net mending--New England. U.S. Fish Wildl. Serv., Fish. Leafl. 241, 17 p.

KOELZ, WALTER.
1926. Fishing industry of the Great Lakes. [U.S.] Bur. Fish., Rep. Comm. Fish. 1925 (1926), append. 11 (Doc. 1001): 553-617.

SUNDSTROM, GUSTAF T.
1957. Commercial fishing vessels and gear. U.S. Fish Wildl. Serv.,Circ. 48, 49 p.

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